



Research Paper

The Frogs of the Shallows of the City Of Korhogo in the North of the Cote D'ivoire: A Still Under-Exploited Fishing Resource

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ABSTRACT:

The contribution of the frog to the supply of proteins of animal origin to the human diet is still weak and poorly known in Côte d'Ivoire. Fishery protein needs, which are mainly met by fish, generate large outflows. However, the country has vast natural potentials favourable to the exploitation of other resources such as frogs. If properly developed, this frog exploitation activity can help reduce fish imports and enhance food security. In the town of Korhogo, where large frog consumption markets have gradually been established, this reality is even more palpable. This research aims to demonstrate that the human and material resources used in the city of Korhogo for frog exploitation are not conducive to its prosperous fishery. The methods used for data collection are based on documentary research, interviews with farmers and a questionnaire survey. The results show that the majority of the farmers are students who engage in the activity in their free time. The techniques and tools used for catching fish are bare hands and hooks. All these factors constitute an impediment to the efficient production of this fishery resource.

KEYWORDS: City of Korhogo, Northern Côte d'Ivoire, Lowland frog, under-exploited fishery resource.

Received 15 December, 2020; Accepted 30 December, 2020 © The author(s) 2020.

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I. INTRODUCTION

The contribution of the frog to the supply of proteins of animal origin to the human diet is still weak and poorly known in Côte d'Ivoire. However, the consumption of this animal, for 100 grams of edible substance like the *Rana Esculenta* species, provides 19.29 g of nitrogenous substances, 0.20 g of lipids, 430 mg of phosphorus, 20 mg of calcium and 15.50 g of proteins (NEGRONIE G., FARINA L.; 1993). Because of this nutritional value, the consumption of the frog is widespread throughout the world. Notably, India, Turkey, Bangladesh, Indonesia produce and satisfy the consumer markets of France and the United States of America (NEGRONIE G., FARINA L.; 1993).

In Côte d'Ivoire, for a long time, the consumption of frogs was confined only in the homes of the western populations where the morals integrated the consumption of this animal in the culinary habits. They could also be found in the dishes of some luxurious restaurants in the large Abidjan metropolis located in the south of the country.

But, from 2012, in the city of Korhogo in northern Côte d'Ivoire, there is a net and gradual increase in demand for these proteins of fish origin. Indeed, the redeployment of the public administration, the creation of the University Peleforo Gon and the implementation of several development projects that occurred after the post-electoral crisis have caused a migration of several populations from other areas of the country to the city of Korhogo. This displacement of populations has favoured on the one hand the increase of the population to 275,111 inhabitants in 2017 (INS; 2017) and on the other hand, it has injected into the urban fabric, populations whose culinary habits take into account the consumption of frogs. This new configuration of the urban framework leads to constraints, in particular the satisfaction of this population's needs in proteins of halieutic origin. Timidly served in fish, the frog supply seems to be one of the avenues to be explored.

Indeed, the city of Korhogo has a belt of lowland in which, the strong and permanent presence of market gardening attracts frogs that come to feed on the insects found there. The numerous wells, serving as water supply bases for the operators and which litter the market gardens, shelter these insect predators. It is thus from these shelters that these frogs are extirpated for the consumer markets. However, the supply fails to meet

consumer demand. However, if properly exploited, this fishing potential can contribute to the supply of animal proteins to the population and strengthen food security in the town of Korhogo. So, the main question of this article is to know how the frog production activity is organized in the city of Korhogo. What are the socio-demographic and professional characteristics of the individuals engaged in this activity? What means do they use to collect their prey?

In hypothesis, we admit that the human and material means implemented in the town of Korhogo for the exploitation of frogs are not conducive to a prosperous fishery. We will describe the socio-demographic characteristics of the actors and analyze the techniques used for the capture of frogs.

II. MATERIALS AND METHODS

2.1 Study site and species exploited

2.1.1 Study site

The city Korhogo is one of the most important agglomerations of the Ivory Coast. According to the National Institute of Statistics (INS), this city located in the north of the country had in 2017 about 275 111 inhabitants. It is crossed by several lowlands where fisheries ensure the capture of frogs (Fig. 1).

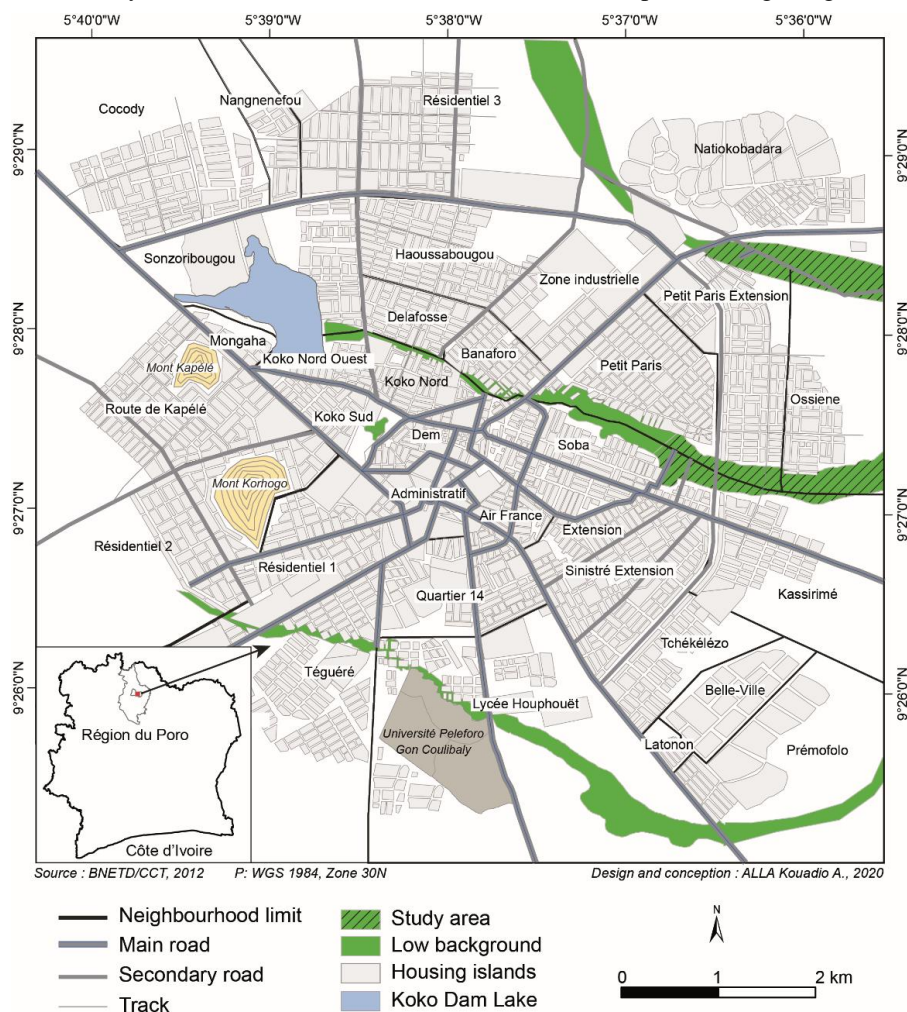


Figure 1: Presentation of the study areas

2.1.2 Species studied

The agile frog (*Rana dalmatina*) is a species found mainly in lowland areas and can be found up to more than 1300 m above sea level. Its favourite terrestrial habitat remains wooded formations and thickets such as forests, deciduous woodlands or hedgerows. It can also be found in wetter areas and meadows. In the aquatic phase, the agile frog particularly appreciates ponds, being found in forests, clearings or in a meadow adjacent to a wooded area. It is also found, to a lesser extent, in small temporary pools of stagnant water, generally formed by rainfall, such as ruts or temporary ponds (RÉGNIER Valérie, NEVEU A., 1985). In the town of Korhogo,

these frogs are found in the lowlands, where a significant number of individuals carry out their market gardening activities.

2.2 Methodological approach

2.2.1 Materials and data

The devices used in this study were HTC Desire 626 GPLUS Dual SIM and SAMSUNG Android phones, all equipped with GPS and Maverick application. They were used for the geolocation of the frogs' points and exploitation areas. By means of the Kobotoolbox software the questionnaires were carried out. They were integrated into the Android phones and administered to the respondents from the Kobocollect application. The cartographic software Qgis 3.12, Adobe Illustrator CC 2017 drawing software and a georeferenced plot of land in the city of Korhogo were also used.

The data used came from a field survey conducted in September, October and December 2019 and from a document search on Google search engines.

2.2.2 Data collection methods

Literature review and field surveys were the main methodological approaches used in the writing of this article.

The literature search was used to explore the literature related to the exploitation of fisheries resources in aquatic spaces. This phase was followed by a field survey carried out during the months of September, October and December on all the survey sites. The field research mobilized several techniques for the collection of information. These included interviews, a questionnaire survey, locating contact information for certain useful points and direct observation of frog harvesting sites.

Due to the lack of a database providing us with a list of the farmers, we visited each farm site and interviewed the fishermen we met in the field. This method made it possible to survey 24 fishermen at the two sites. The concerns contained in the questionnaire were to seek information on the age, profession, ethnicity, and neighbourhood of residence of the fishermen. The same questionnaire was used to find out about the techniques and tools used to collect the frogs.

Interviews were also conducted with some fishermen. These interviewees were chosen by age group. Thus, interviews were conducted with two groups of individuals from each age group (young, adult and old). The interviews focused on the conditions of access to the catching areas, the reasons and frequency of practice of the activity, etc. The interviews were carried out with the fishermen and the fishermen's families.

The period of questionnaire administration was used to locate the coordinates of points as well as for direct observations.

2.2.3- Information processing

The information collected was analysed using the Kobotoolbox software and the Sphinx millennium 14.5. This operation allowed the extraction of statistical data compiled in a table on Excel 2016. These data were transferred to the Sphinx millennium 14.5 for the analysis of single-entry tables.

A cartographic treatment of these data allowed the conversion of the coordinates of the sampled points and the transformation of the tables containing the location coordinates of the respondents, stored in the Excel software, into a shapefile from the Qgis 3.12 software. These data were used to create maps using Qgis and refined in Adobe Illustrator CC 2017. The maps made from these manipulations show the frog capture spaces.

Also, from a table in which the answers of our interviewees were transposed, the analysis of the content of the speeches of the interviews was carried out.

At the end of the various treatments, the results obtained were organized around the socio-professional characteristics of the farmers, the techniques and quantities exploited, and the economic interests of this activity.

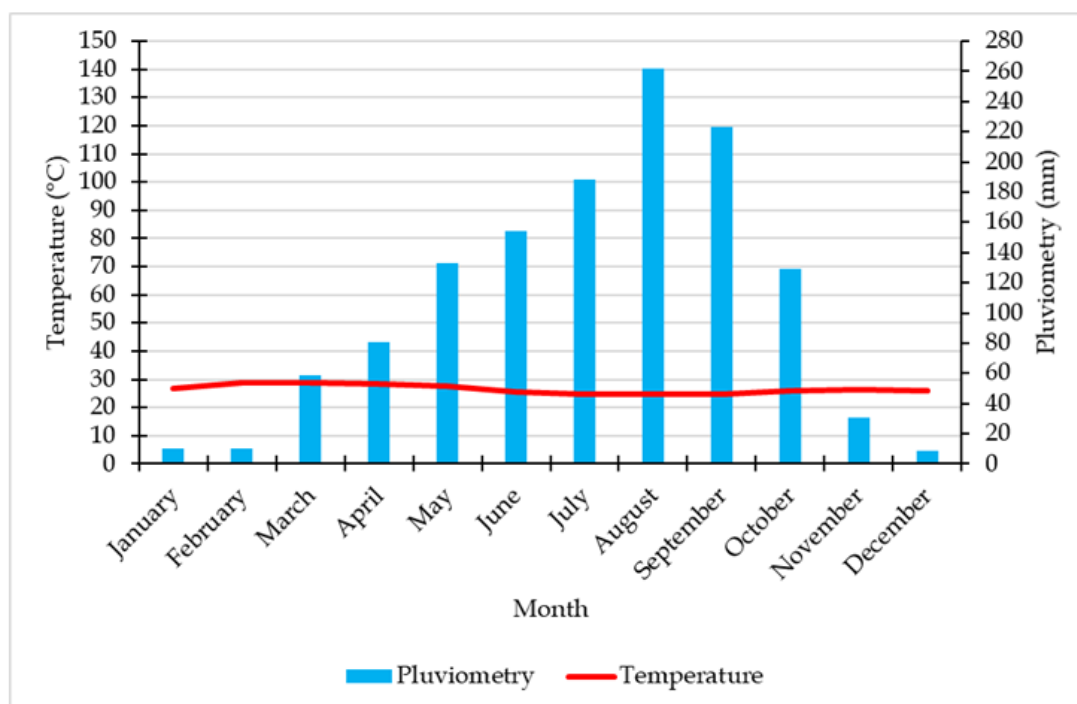
III. RESULT

3.1 Favourable factors for frog proliferation

Analysis of the documents shows that the city of Korhogo has several factors conducive to the proliferation of frogs. These include the climate and especially the biotope of the flora and fauna.

3.1.1 A Sudanese type of climate favourable to the survival of frogs

The city of Korhogo is located in the intertropical zone. It is located precisely between 9°25'15"/9°29'56" North Latitude and 5°35'11"/5°40'29" West Longitude (Fig. 1). This position confers to this locality a very hot and dry climate (of the type of the Sudanese climate), with, in December and January, the harmattan, a powerful wind coming from the Sahara, which lowers the temperature considerably. The great dry season (October - May) precedes the rainy season marked by a peak rainfall in August (Fig. 2).



Source : levoyageur.net/climat-ville-KORHOGO.html
Figure 2: Ombrothermal diagram of the city of Korhogo in 2019

The ombrothermal diagram above shows the two main seasons of the zone with an accentuation of drought in December (9 mm), January (10 mm) and February (10 mm) and abundant rainfall in July (188 mm), August (262 mm) and September (223 mm). The average rainfall varies between 1100 mm and 1600 mm. As for temperature, its average fluctuates between 24 and 33 °C.

3.1.2 Nutritional conditions

In the lowlands of the town of Korhogo, there is a very intense agricultural activity. This is particularly the market gardening related to the production of peppers, onions, cabbage, mint, tomatoes, etc. (photo 1 and 2).



Photo 1: Tomato crop



Photo 2: Furrow for cabbage cultivation

Photographs: ALLA, 2020

In these areas of various cultures, a multitude of insects that are favourable to frogs' feeding abound. During our field visits, we were able to observe the presence of insects that constitute a kind of bait for the frogs.

Also, to take cover, frogs use puddles as shown in photo 2 to get away from the eyes of their predators. In other cases, the shelters of these amphibians are wells made by market gardeners to store the water used to

water the plants. It is therefore in these spaces where the frogs find shelter and food that they are hunted by fishermen. What are the socio-demographic and professional characteristics of these farmers?

3.2 Socio-demographic and professional characteristics of operators

3.2.1 Socio-demographic characteristics of operators

In the shallows of the town of Korhogo, the frogs are exploited in an artisanal way. Our investigations in these areas revealed 24 actors, all of Ivorian nationality belonging to two ethnic groups (Table 1).

Table 1: Distribution of frog farmers by ethnicity

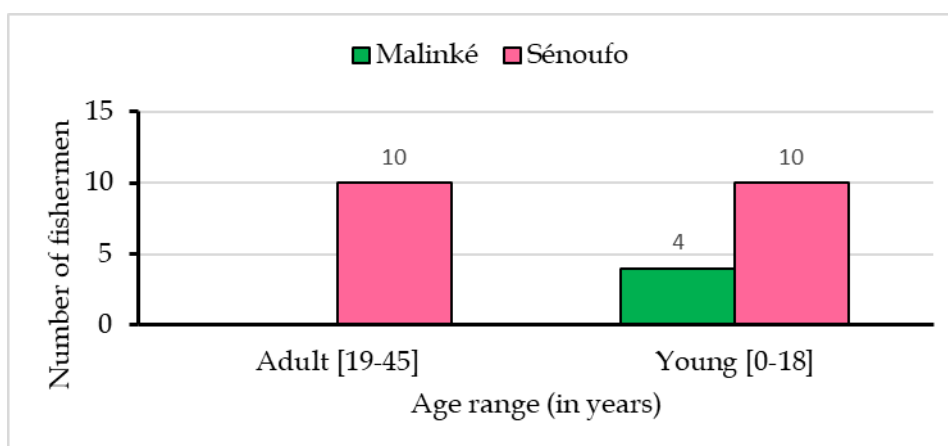
| Ethnie | Workforce surveyed | Frequency (%) |
|---------|--------------------|---------------|
| Malinké | 04 | 16,70 |
| Senoufo | 20 | 83,30 |
| TOTAL | 24 | 100,00 |

Source: Field Survey, 2020

The table below shows that the capture of frogs in the shallows of the town of Korhogo is in the hands of Senoufo and Malinkés. The populations practicing this activity are entirely indigenous. Among them, the Senoufo are counted in large numbers. Of the 24 fishermen surveyed, 20 are Senoufo, i.e. a proportion of 83.30% against 04 Malinkés representing 16.70% of the total workforce.

Whether Senoufo or Malinké, these fishermen are mostly in the youth age group. The average age of these fishermen varies between 17 and 19 years (Figure 2).

Figure 2: Distribution of Korhogo City Lowland Frog Operators by Age Group



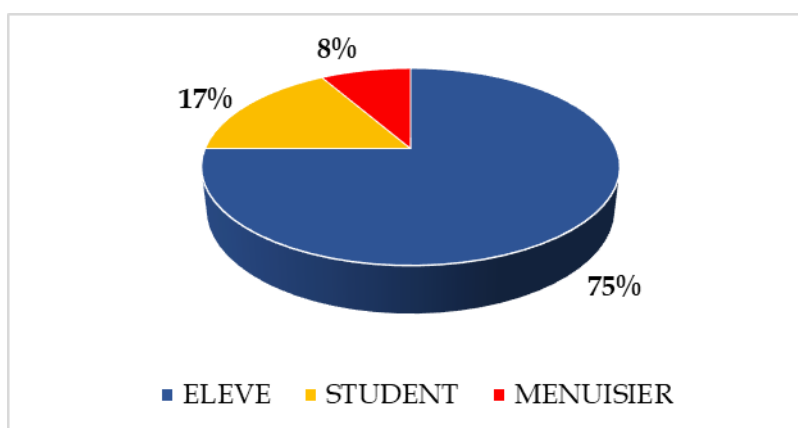
Source: Field Survey, 2020

Figure 2 shows a strong presence of actors in the 0-18 age group. They represent 14 of the fishermen, i.e. 58.34% of the actors surveyed. The 10 others are adults whose age group is between 19 and 45 years old. Considering the age of these fishers, one may wonder if they carry out this activity of catching frogs as a main activity or an activity to fill their free time.

3.2.2- Professional status of operators

The frog fishermen of the shallows of the town of Korhogo are not fully occupied with this activity. They all have other occupations (Figure 3).

Figure 3: Distribution of Frog Operators by Related Occupations



Source: Field Survey, 2020

The figure above shows that all the fishermen surveyed have an occupation other than catching frogs. They are mostly students representing 75% of the workforce and 17% are academics. In sum, it is therefore an activity that is in the hands of the young people attending school, i.e., 92% of the operators. What tools do they use to carry out their activity?

3.3 Techniques and quantities exploited

The techniques used to capture frogs in the shallows of the town of Korhogo are bare hands (Photos 3 and 4).



Photo 3: Downhole exploration



Photo 4: Downhole exploration

Photographs: ALLA, 2020

The young fishermen go down into the waters of the swamps bordering the marshes to search for their prey. Sometimes, the exercise of their activity leads them to go down into the wells littering the tomato or cabbage crops to catch frogs.

Photo 3 shows two young fishermen in the exercise of their activity. In this picture, the young Sekongo and Yeo devote their Sunday to the excavation of the swampy areas of the city's lowlands in order to take some frogs for sale. On picture 4, we find the same team enriched by another one of their friends in action, but this time in a well to capture frogs.

The quantities produced per outing vary according to the duration of the activity, the skill of the fisherman and also according to the seasons. A fishing trip lasting 08 hours during the rainy season, which is supposed to be the season of abundance, allows the actors to obtain the quantities summarized in Table 2 below.

Tableau 2: Distribution of the average quantities of frogs caught per eight-hour duration trip

| Quantity produced per capture output | Staff | Proportion (%) |
|--------------------------------------|-------|----------------|
| Less than 10 | 4 | 16,67 |
| From 10 à 15 | 4 | 16,67 |
| From 16 à 20 | 4 | 16,67 |
| 20 and more | 12 | 50,00 |
| Total | 24 | 100,00 |

Source: Field Survey, 2020

Table 2 shows that half, or 50% of the actors in this activity manage to obtain more than 20 frogs per outing with a duration of 8 hours of operations. On the other hand, 16.67% of them reported catching less than 10 frogs for the same duration. Two groups of fishers with the same proportions, i.e., 16.67, can have respectively between 10 to 15 and 16 to 20 frogs. What are the places of sale and what are the costs of these productions?

3.4- Location of marketing and farm revenues

The production of lowland frogs in the town of Korhogo has specified areas. The absorption of these products is done by restaurant owners and households that make orders with fishermen. Table 4 below shows the proportions of these sales areas.

Tableau 4: Representation of frog sales locations according to frequencies

| Place of marketing of sockets | Number of occurrences | Frequency (%) |
|-------------------------------|-----------------------|---------------|
| Restaurant | 12 | 37,50 |
| Concession | 18 | 56,25 |
| Others | 2 | 6,25 |
| Total | 32 | 100,00 |

Source: Field Survey, 2020

Analysis of the above table shows that 56.24% of frog sales are made to certain households living in concessions. Our surveys have shown that these households generally come from the west of Côte d'Ivoire, where a habit of consuming frogs is entrenched in people's customs. These sales are also made in restaurants. These restaurants are public spaces selling food in the form of gargots that are visited daily by consumers (photo 5).



Photo 5: Frog marketing restaurant in the Tégouéré district of the city
Photographs: ALLA, 2020

In this restaurant, according to the manageress, two bags of frogs estimated at 100 000 FCFA are sold, per week, to consumers from several neighbourhoods of the city of Korhogo. In the foreground of photo 5, a

consumer has come to buy a dish that she takes home. The dishes are either fried or in soup accompanied by rice or ‘‘attiéké’’¹. The price of these dishes is fixed and costs 1,000 FCFA.

However, the unit price of a frog varies according to its size and the period of capture. A frog caught in periods of abundance can cost 150 FCFA (small size), 250 (medium size), and 300 to 350 FCFA (large size). During periods of scarcity in the dry season, these prices can double or even triple in the same sales markets.

IV. DISCUSSIONS

The climatic and nutritional conditions of the city of Korhogo are favourable to the proliferation of certain species of amphibians. The agile frog (*Rana dalmatina*) finds in the shallows of this urban agglomeration, several insects favourable to its food and especially puddles as well as wells for its shelter. This animal made in dishes has several nutritional qualities to fight against food insecurity. Also, its exploitation constitutes an important source of diversification of the population's income. However, activities related to the exploitation of these amphibians are still not very widespread in this city.

Indeed, in the town of Korhogo, the undeniably promising exploitation of these frogs is in the hands of young people. They belong to the 0 to 18 age group and represent 58.34% of producers whose main activity is going to school. However, in the context of finfish exploitation, a study carried out by KOUDOU et al. (2020) on the Koko dam, revealed the presence of 41 female fishermen whose age varies between 25 and 65 years. Among these producers, 63.41% are engaged only in fishing and the frogs are not among their sought-after prey. From this reality added to the results of our study, we cannot attribute the low diffusion of frog exploitation in the town of Korhogo to climatic or other conditions of development of these amphibians. Rather, cultural factors must be indexed. This is revealed by ALLA (2016), which states that the involvement of indigenous people in fishing activities in the department of Korhogo is only very partial. With the exception of collective fishing practiced by the riparian populations during the period of drying up of the water bodies, the Sénoufos and Dioulas constituting the original populations of the region do not practice fishing. In the department of Ferkessédougou, close to that of Korhogo, in which fishing activity is relatively more intense, this observation of the absence of indigenous people in the exercise of the activity is also present (SILUE et al., 2020). What can be said about the capture of frogs, which is only a new activity in the area. Moreover, the work carried out by DA COSTA et al. (1998), on behalf of IDESSA/CRDI (Institut des Savanes /Centre de Recherches pour le Développement International) to identify the species caught in the dams of the North, did not take into account the presence of frogs. The work revealed the presence of five ubiquitous taxa (*Sarotherodon galilaeus*, *Tilapia zillii*, *Clarias* spp, *Oreochromis niloticus*, *Heterotis niloticus*), and two species introduced in some dams. Thus, the activity of catching frogs is relegated to second place and especially in the hands of school children.

The tools used to practice this activity are bare hands. Only in rare cases do some fishermen use the rod. This reality is in line with DJAWARA's (2019) statements on the production of *Atya scabra* in the town of Aboisso. According to this author, for the capture of *Atya scabra*, the fisherman dives underwater and heads towards the rocks where these preys are buried. He sinks his hand under the rocks in search of the object of his lust. If he finds any, he picks them up carefully to avoid being pinched by the animals. Also, according to the same author, the oxygenation conditions being difficult underwater, the fisherman is obliged to return to the surface several times during a fishing operation. In these conditions, the results of this activity remain fruitless and unable to satisfy the demands of the populations.

The retail prices at which the frogs are sold to restaurant owners are much lower than the prices of the dishes set for the end consumers. In these sales areas, the frog dish is sold at 1,000 FCFA, which is equivalent to five times the price of a meal ticket served in the city's university restaurant. The analysis shows that the capture activity provides only derisory income to producers to such an extent that they can only use it to buy the missing school supplies and certain vital needs such as toothpaste, soap and food during the day. But the reality is different for the reseller. In the town of Korhogo, a dish with a financial value of 1,000 FCFA is a luxury dish inaccessible to the poorer social strata. However, this layer of the poor, and moreover with the largest population, is more likely to popularize the consumption of *Rana dalmatina* whose protein importance is no longer to be demonstrated. In its current state, the frog on sale for consumption is not available in all the supermarkets in the city of Korhogo. Anything that compromises its contribution to the fight against food insecurity.

V. CONCLUSION

The city of Korhogo has natural conditions favourable to frog growth. Their farms provide a nutritional contribution to the fight against food insecurity. This activity could be another source of income diversification for the population.

¹ Attiéké : Steamed cassava semolina

However, the exercise of this activity is not widespread among the fishermen of this locality. It remains an activity in the hands of young people attending school and is practiced with rudimentary methods.

In order to enable the population to enjoy the benefits of frog farming, the involvement of state and non-state structures is recommended. The role of these structures will be to create the conditions for improving production and, above all, to train people to raise these frogs, as is done elsewhere in other countries.

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